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FORM PTO-1390 (REV. 5-93) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		CASE NO. 56/367 U.S. APPLICATION NO. (If known, see 37 C F R 1 5) 10/019734
INTERNATIONAL APPLICATION NO. PCT/EP00/05372	INTERNATIONAL FILING DATE June 10, 2000	PRIORITY DATE CLAIMED July 1, 1999

TITLE OF INVENTION
COUPLING ELEMENT AND USE OF SAID COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

APPLICANT(S) FOR DO/EO/US
Johann Mitterreiter

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)).
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)) (Two (2) Amended Sheets for Specification, one (1) Amended Sheets for the Claims).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)) and/or amendments under Article 34.

Items 11. to 16. Below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
    ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☐ Other items or information:

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) Unassigned 10/019734	INTERNATIONAL APPLICATION NO PCT/EP00/05372	CASE NO 56/367

17. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)): Search Report has been prepared by the EPO or JPO $890.00		
International preliminary **examination** fee paid to USPTO (37 CFR 1.492(2)(1)) $710 00		
No international preliminary examination fee paid to USPTO (37 CFR 1 482) but international **search** fee paid to USPTO (37 CFR 1.492(a)(2)) $740 00		
Neither international preliminary **examination** fee (37 CFR 1.482) nor international search fee (37 CFR 1.492(a)(3)) paid to USPTO..... $1,040.00		
International preliminary examination **fee** paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) $100 00		
ENTER APPROPRIATE BASIC FEE AMOUNT	$890 00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1 492(e)).	$130.00	

Claims	Number Filed	Number Extra	Rate		
Total Claims	46 - 20 =	26	x $ 18 00	$468.00	
Independent Claims	4 - 3 =	1	x $ 84.00	$84.00	
Multiple dependent claim(s) if Applicable)		0	+ $280 00	$0 00	
			TOTAL OF ABOVE CALCULATIONS =	$1,572 00	
Reduction by ½ for filing by small entity, if applicable Small Entity statement must also be filed. (Note 37 CFR 1 9, 1.27, 1.28)					
			SUBTOTAL =	$1,572 00	
Surcharge of $130.00 for furnishing the English translation later than the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1 492(f))				$	
			TOTAL NATIONAL FEE=	$1,572.00	
Fee for recording the enclosed assignment (37 CFR 1 21(h)) The assignment must be accompanied by an appropriate cover sheet (37 CFR 3 28, 3.31), $40 00 per property +					
			TOTAL FEES ENCLOSED=	$1,572.00	
				Amount to be refunded	$
				charged	$

a. ☒ A check in the amount of $1,572 00 to cover the above fees is enclosed

b. ☐ Please charge my Deposit Account No. 23-1925 in the amount of to cover the above fees A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No 23-1925. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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"Express Mail" mailing label number EL513142757US

Date of Deposit December 28, 2001

PATENT
CASE NO. 56/367

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application: Johann Mitterreiter International Patent Application No. PCT/EP00/05372 International Filing Date: June 10, 2000 U.S. Patent Application Serial No.: unassigned Filed: December 28, 2001 For: COUPLING ELEMENT AND USE OF SAID COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES	Group Art Unit: unassigned Examiner: unassigned

PRELIMINARY AMENDMENT

The Commissioner for Patents
United States Patent and Trademark Office
Washington, D.C. 20231

Dear Sir:

This Preliminary Amendment is being presented to better describe Applicant's claimed invention and it is believed does not present any new matter. Please amend the specification and the claims as follows:

In the Specification:

On replacement page 1, line 1, replace the title with the following title:

COUPLING ELEMENT AND USE OF THE COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

On replacement page 1 after the title and before line 3, insert the following new paragraphs and headings as follows:

Applicant claims, under 35 U.S.C. §§ 120 and 365, the benefit of priority of the filing date of June 10, 2000 of a Patent Cooperation Treaty patent application, copy attached, Serial Number PCT/EP00/05372, filed on the aforementioned date, the entire contents of which are incorporated herein by reference, wherein Patent Cooperation Treaty patent application Serial Number PCT/EP00/05372 was not published under PCT Article 21(2) in English.

Applicant claims, under 35 U.S.C. § 119, the benefit of priority of the filing date of July 1, 1999 of a German patent application, copy attached, Serial Number 299 11 508.9, filed on the aforementioned date, the entire contents of which are incorporated herein by reference.

Background of the Invention

Field of the Invention

Replace the paragraph beginning on replacement page 1, line 3 with the following paragraph:

The present invention relates to a coupling element for connecting two components in a radially resilient, but torsion-proof manner.

On replacement page 1, between lines 4 and 5 insert the following heading:

Description of the Related Art

Replace the paragraph beginning on replacement page 1, line 5 with the following paragraph:

For manufacturing such coupling elements in a cost- effective manner, they are made of one piece and shaped from sheet metal, such as described, for example, in DE 89 15 109 U1, EP 0 762 081 A1 and EP 0 762 082 A1. Note that EP 0 762 081 A1 corresponds to U.S. Patent No. 5,771,594 and EP 0 762 082 A1 corresponds to U.S. Patent No. 5,758,427, the entire contents of each of which are incorporated herein by reference. These coupling elements include a flat center piece as the base, and of four brackets, formed thereon by bends. The brackets extend perpendicularly in relation to the level of the base, and respectively two brackets are arranged opposite and parallel to each other and form a spring parallelogram for radial compensation. To achieve the function of a spring parallelogram, the brackets extend axially and are formed at one location of the base and can be rigidly connected with one of the two components at another location axially remote from the first. The torsion-proof property is reduced because of this axial remoteness and, in the course of a radial deflection of a spring parallelogram, the base is also unavoidably bent because of the axial linear change of the brackets. In an actual case, the base does not bend symmetrically here because of inhomogeneities in the base, because of which the base introduces an angular twist in the remaining two brackets, which causes a mutual twisting of the two components connected via the coupling element.

Replace the paragraph beginning at replacement page 1, line 20 with the following heading and paragraph:

SUMMARY AND OBJECTS OF THE INVENTION

It is an object of the present invention to create a coupling element which is compactly and space-savingly constructed and can be produced cost-effectively. Moreover, radial compensation movements of the two components connected by the coupling element should be possible without introducing impermissible mutual twisting between the two components.

Replace the paragraph beginning at replacement page 1, line 25, with the following paragraph:

This object is attained by a coupling element for an angle-measuring device for connecting a first component to a second component in a radially resilient, but torsion-proof manner with respect to an axis of rotation. The coupling element including a base and a first bracket rigidly fastened on the base and the first component, wherein the first bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations. One of the first outer support connection locations of the first bracket and the inner support connection location of the first bracket forms a connection of the first bracket and the base and the other of the first outer support connection location of the first bracket and the inner support connection location of the first bracket is rigidly connected with the first component. A second bracket is rigidly fastened on the base and on the second component and which extends at a right angle with respect to the first bracket, wherein the second bracket has a first outer support connection location, a second outer support

connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations of the second bracket. One of the first outer support connection locations of the second bracket and the inner support connection location of the second bracket forms a connection of the second bracket and the base and the other of the first outer support connection location of the second bracket and the inner support connection location of the second bracket is rigidly connected with the second component. Flexural strength of the first bracket in a region along the axis of rotation between the inner support connection location of the first bracket and a connecting line of the first and second outer support connection locations of the first bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the first bracket and the first and second outer support connection locations of the first bracket. Flexural strength of the second bracket in a region along the axis of rotation between the inner support connection location of the second bracket and a connecting line of the first and second outer support connection locations of the second bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the second bracket and the first and second outer support connection locations of the second bracket.

Replace the paragraph beginning at replacement page 1, line 27 with the following paragraph:

The present invention furthermore relates to the use of this coupling element

in an angle-measuring device.

Replace the paragraph beginning at replacement page 2, line 2, with the following paragraph:

It is therefore a further object of the present invention to disclose an angle-measuring device, wherein the scanning unit is coupled to the stator of the angle-measuring device in a particularly torsion-proof, but radially resilient manner and, if possible, no measuring errors result from radial compensation movements between the scanning unit and the stator.

Replace the paragraph beginning at replacement page 2, line 6, with the following paragraph:

This object is attained by an angle-measuring device that includes a scanning unit, a stator and a coupling element connected to the stator and the scanning unit in a torsion-proof, but radially resilient manner with respect to an axis of rotation. The coupling element including a base and a first bracket rigidly fastened on the base and the first component, wherein the first bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations. One of the first outer support connection locations of the first bracket and the inner support connection location of the first bracket forms a connection of the first bracket and the base and the other of the first outer support connection location of the first bracket and the inner support connection location of the first bracket is rigidly connected with the first component. A second bracket is rigidly fastened on the base and on the second

component and which extends at a right angle with respect to the first bracket, wherein the second bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations of the second bracket. One of the first outer support connection locations of the second bracket and the inner support connection location of the second bracket forms a connection of the second bracket and the base and the other of the first outer support connection location of the second bracket and the inner support connection location of the second bracket is rigidly connected with the second component. Flexural strength of the first bracket in a region along the axis of rotation between the inner support connection location of the first bracket and a connecting line of the first and second outer support connection locations of the first bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the first bracket and the first and second outer support connection locations of the first bracket. Flexural strength of the second bracket in a region along the axis of rotation between the inner support connection location of the second bracket and a connecting line of the first and second outer support connection locations of the second bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the second bracket and the first and second outer support connection locations of the second bracket.

Replace the paragraph beginning at replacement page 2, line 8, with the

following paragraph:

Particular advantages of the present invention are recited in the following description of exemplary embodiments.

Replace the paragraph beginning at replacement page 2, line 11, with the following paragraph:

Exemplary embodiments of the present invention are represented in the drawings.

Replace the paragraph beginning on replacement page 2, line 13 with the following heading and paragraph:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a first exemplary embodiment of a coupling element, viewed in the axial direction according to the present invention;

Replace the paragraph beginning at replacement page 2, line 15 with the following paragraph:

FIG. 2 shows a lateral view of the coupling element in accordance with FIG. 1 taken along line II-II of FIG. 1;

Replace the paragraph beginning at page 3, line 1 with the following paragraph:

FIG. 3 shows a stereoscopic representation of the coupling element in accordance with FIGS. 1 and 2;

Replace the paragraph beginning at page 3, line 3 with the following paragraph:

FIG. 4 shows a top view of an embodiment of a shaft adapter with the

coupling element of FIGS. 1-3 in accordance with the present invention;

Replace the paragraph beginning at page 3, line 5 with the following paragraph:

FIG. 5 shows a partial sectional view of the shaft adapter of FIG. 4 taken along lines V-V of FIG. 4 in accordance with FIG. 4;

Replace the paragraph beginning at page 3, line 6 with the following paragraph:

FIG. 6 shows an embodiment of an angle-measuring device with the coupling element in accordance with the present invention;

Replace the paragraph beginning at page 3, line 8 with the following paragraph:

FIG. 7 shows a second exemplary embodiment of a coupling element in accordance with the present invention; and

Replace the paragraph beginning at page 3, line 9 with the following paragraph:

FIG. 8 shows a stereoscopic representational view of a third exemplary embodiment of a coupling element in accordance with the present invention.

Replace the paragraph beginning on page 3, line 11 with the following heading and paragraph:

DESCRIPTION OF THE PREFERRED EMBODIMENT(S) OF THE INVENTION

A first exemplary embodiment of a coupling element 1 is represented in FIGS. 1 to 3. The coupling element 1 has been produced in one piece as a punched and bent element and is made of a material with a high degree of alternating stress resistance,

in particular of spring steel. It includes a flat center area as the base 2, as well as four brackets 3, 4, 5, 6 formed thereon and bent at right angles. The brackets 3, 4, 5, 6 are aligned, at least to a large degree, parallel in relation to the axis D, they are furthermore arranged diametrically opposite each other and parallel with each other. The bracket 3 is arranged diametrically opposite and parallel with the bracket 5. The bracket 4 is also arranged diametrically opposite and parallel with the bracket 6, wherein the brackets 3 and 5 extend at right angles to the brackets 4 and 6.

Replace the paragraph beginning at page 3, line 20 with the following paragraph:

Each bracket 3, 4, 5, 6 is fixed, centered atop a support on the base 2, and each bracket 3, 4, 5, 6 has respective further outer support connection locations or points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 on both sides of these inner support connection locations or points 3.1, 4.1, 5.1, 6.1. The diametrically oppositely located support points 3.2, 3.3 and 5.2, 5.3 are used for the rigid fastening of the brackets 3, 5 on one of the two components, and the diametrically oppositely located support points 4.2, 4.3 and 6.2, 6.3 are used for the rigid fastening of the brackets 4, 6 on the other of the two components. All support points 3.1 to 6.3 advantageously lie in a common plane that extends at a right angle to an axis of rotation D of a shaft 31 of a rotor 30. The inner support points 3.1, 4.1, 5.1, 6.1 are centered in a circumferential direction with respect to the axis C between corresponding outer support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.2, 6.2, 6.3. The support points 3.1, 4.1, 5.1, 6.1 are formed by bending lines between the base 2 and the brackets 3, 4, 5, 6. The support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 are embodied as bores for fastening by screws, wherein the centers of

the bores are located together in the center plane of the base 2. However, other rigid fastening methods, for example welding, can also be provided. The three support points 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3 of each bracket 3, 4, 5, 6 are advantageously located on a common straight line, wherein the extensions of the straight lines enclose a rectangular square.

Replace the paragraph beginning at page 4, line 2 with the following paragraph:

The base 2 advantageously includes four braces, which connect the support points 3.1, 4.1 and 4.1, 5.1 and 5.1, 6.1, as well as 6.1, 3.1 in one plane and enclose a square. In this case the center lines of the braces extend at least approximately in the direction of the lines of application of the force which is introduced at the support points 3.1, 4.1, 5.1, 6.1.

Replace the paragraph beginning at page 4, line 6 with the following paragraph:

This described coupling element 1 can be employed in connection with angle-measuring devices in that it is inserted between the shaft of a drive mechanism and the shaft of an angle- measuring device. A shaft adapter 9 with the coupling element 1 in accordance with FIGS. 1 to 3 is represented in FIGS. 4 and 5. The coupling element 1 can be inserted in a particularly simple way between the shaft of the drive mechanism to be measured and the shaft of the angle-measuring device by this shaft adapter 9. The shaft adapter includes a first flange 9.1, on which the shaft of the drive mechanism can be rigidly fastened, and of a second flange 9.2, on which the shaft of the angle-measuring device can be rigidly fastened. In the example represented, the

first flange 9.1 is a plate with bores 9.11, so that the plate can be fixed in place on the shaft of the drive mechanism by being screwed together with it. The second flange 9.2 includes a second plate with a centered bore 9.21, in which the shaft of the angle-measuring device can be fixed in place by radial clamping.

Replace the paragraph beginning at page 4, line 18 with the following paragraph:

The two outer support points 6.2, 6.3 and 4.2, 4.3 of the two diametrically oppositely located brackets 6 and 4 are rigidly connected with the first flange 9.1 by screws 8, and the two outer support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 extending at right angles to them are rigidly connected with the second flange 9.2 by screws 7. The two flanges 9.1, 9.2 are connected with each other via the coupling element 1 in a radially and axially resilient, but torsion-proof manner, in relation to the axis of rotation D. For reasons of clarity the support points of the brackets 3 to 5 have not been provided with reference symbols, reference is made with respect to this to FIG. 3. The shafts of the drive mechanism and of the angle-measuring device have also not been represented for reasons of clarity.

Replace the paragraph beginning at page 4, line 31 with the following paragraph:

In a known manner, the angle-measuring device includes a stationary part, also called mounting flange, of the angle- measuring device, or stator 10 in general, a scanning unit 20 and a rotating element, also called a rotor 30. The rotary position of the rotor 30 with respect to the stator 10 is measured. The rotor 30 in turn includes a shaft 31, which is seated in the scanning unit 20 and on which a code disk 32 is

fastened. The scanning unit 20 includes a support body 21, on which a light source 22, a scanning plate 23 and a receiver unit 24 for the photoelectric scanning of the code disk 32 are arranged. The stator 10 can also be the stationary portion of a drive mechanism. For example the mounting flange of a motor, on which the scanning unit is installed.

Replace the paragraph beginning at page 5, line 8 with the following paragraph:

The shaft 31 of this angle-measuring device can be rigidly installed on a shaft to be measured, because alignment errors are compensated by the coupling element 1, which is integrated into the angle-measuring device. For this purpose, the brackets 4 and 6 are rigidly fixed in place on the stator 10 of the angle measuring device via the support points 4.2, 4.3, 6.2, 6.3. Only one of the screws 7 used for this is represented. The brackets 3 and 5 of the coupling element 1 are rigidly fixed in place on the scanning unit 20 by screws 8 via the support points 3.2, 3.3 and 5.2,. 5.3. Because of alignment errors between the shaft to be measured, not represented, and the shaft 32, the scanning unit 20 performs tumbling movements in relation to the stator 10, which are compensated by the coupling element 1 without the scanning unit 20 performing a rotation around the axis of rotation D in the process. If in the course of the rotation of the shaft 31 the scanning unit 20 is displaced in the radial direction R because of alignment errors, the support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 are displaced in this direction R with respect to the support points 3.1 and 5.1. Because of the symmetrical arrangement of the support points 3.2, 3.3 with respect to the center support point 3.1, as well as the support points 5.2, 5.3 with respect to the

center support point 5.1, this displacement does not introduce a rotating movement into the coupling element 1. The actually occurring displacements are so small that they are compensated by the symmetrical stretching of the brackets 3 and 5 in the circumferential direction with respect to the axis of rotation D between inner support points 3.1, 4.1, 5.1, 6.1 and the outer support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3. In connection with displacements of the scanning unit 20 in the radial direction perpendicular to R, the support point 6.1 is radially moved with respect to the support points 6.2 and 6.3, and the support point 4.1 is also radially moved with respect to the support points 4.2 and 4.3. The changes in distance occurring here between the support points 6.2, 6.1, 6.3 of the bracket 6, and between the support points 4.2, 4.1, 4.3 of the bracket 4, are again compensated by the symmetrical stretching in the brackets 6, 4.

Replace the paragraph beginning at page 6, line 14 with the following paragraph:

A second exemplary embodiment of a coupling element 1 is represented in FIG. 7. Since it essentially corresponds to the first exemplary embodiment, the same reference symbols are used and the description is limited to the differences. If particularly strong axial stiffness is demanded, the base 2 can be mechanically reinforced by the application of beads 2.1. If an axial fastening of the sheet metal brackets 3, 4, 5, 6, which are bent at right angles in relation to the base, is demanded, the ends with the support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 can be bent over into the plane of the base 2. All support points 3.1 to 6.3 (centers of the fastening points) again lie in a common plane.

Replace the paragraph beginning at page 6, line 22 with the following paragraph:

The further exemplary embodiment in accordance with FIG. 8 shows a coupling unit 100, wherein the brackets 103 to 106 are formed on the base 102 by their ends being bent at right angles, wherein the support points 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3, which are formed by the bending lines, are located in a common plane, in which the further support points 103.1, 104.1, 105.1, 106.1, which are symmetrically arranged between these support points 103.2 to 106.3, also lie. The center support points 103.1, 105.1 of the brackets 103, 105, which are located parallel across from each other, are used for fastening on one component (for example the first flange 9.1 in accordance with FIG. 4, or the stator 10 in accordance with FIG. 6), and the center support points 104.1, 106.1 of the further brackets 104, 106, which are located parallel across from each other, are used for fastening on the further two components (for example the second flange 9.2 in accordance with FIG. 4, or the scanning unit 20 in accordance with FIG. 6).

Replace the paragraph beginning at page 7, line 6 with the following paragraph:

The described coupling elements 1 and 100 have optimal dimensions, if all support points (3.1 to 6.3, 103.1 to 106.3) are located on a common straight line, and if furthermore all support points (3.1 to 6.3, 103.1 to 106.3) of all brackets (3, 4, 5, 6, 103, 104, 105, 106) are located in a common plane. For reasons of the available fastening opportunities it may be necessary to arrange the center support points slightly axially offset (parallel with the axis D) with respect to the further support

points. The effect in accordance with the present invention of the coupling element is preserved, if the flexural strength of the brackets 3, 4, 5, 6 between the respective center support points 3.1, 4.1, 5.1, 6.1 and the connecting line with the further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the axial direction, also parallel with axis D), is considerably greater than the flexural strength between the center support points 3.1, 4.1, 5.1, 6.1 and the two further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the circumferential direction, i.e. transversely to the axis D), so that in case of a radial displacement of the further support points with respect to the center support point, the brackets are respectively bent between the two further (outer) support points and are therefore stretched.

After line 20 at page 7 insert the following paragraph:

The invention may be embodied in other forms than those specifically disclosed herein without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive, and the scope of the invention is commensurate with the appended claims rather than the foregoing description.

Replace the paragraph beginning at page 8, line 1, with the following paragraph:

I Claim:

After page 10 add a new page 11 to read as follows:

Abstract of the Disclosure

A coupling element for an angle-measuring device for connecting a first component to a second component in a radially resilient, but torsion-proof manner

with respect to an axis of rotation. The coupling element including a base and a first bracket rigidly fastened on the base and the first component, wherein the first bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations. One of the first outer support connection locations of the first bracket and the inner support connection location of the first bracket forms a connection of the first bracket and the base and the other of the first outer support connection location of the first bracket and the inner support connection location of the first bracket is rigidly connected with the first component. A second bracket is rigidly fastened on the base and on the second component and which extends at a right angle with respect to the first bracket, wherein the second bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations of the second bracket. One of the first outer support connection locations of the second bracket and the inner support connection location of the second bracket forms a connection of the second bracket and the base and the other of the first outer support connection location of the second bracket and the inner support connection location of the second bracket is rigidly connected with the second component. Flexural strength of the first bracket in a region along the axis of rotation between the inner support connection location of the first bracket and a connecting line of the first and second outer support connection locations of the first bracket is considerably greater than the

flexural strength in a region along a circumferential direction between the inner support connection location of the first bracket and the first and second outer support connection locations of the first bracket. Flexural strength of the second bracket in a region along the axis of rotation between the inner support connection location of the second bracket and a connecting line of the first and second outer support connection locations of the second bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the second bracket and the first and second outer support connection locations of the second bracket.

In the Claims:

Please cancel claims 1-11, as amended, without prejudice and add claims 12-57 as follows:

12. (New) A coupling element for an angle-measuring device for connecting a first component to a second component in a radially resilient, but torsion-proof manner with respect to an axis of rotation, comprising:

a base;

a first bracket rigidly fastened on said base and said first component, wherein said first bracket comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations;

wherein one of said first outer support connection locations of said first

bracket and said inner support connection location of said first bracket forms a connection of said first bracket and said base and the other of said first outer support connection location of said first bracket and said inner support connection location of said first bracket is rigidly connected with said first component;

a second bracket rigidly fastened on said base and on said second component and which extends at a right angle with respect to said first bracket, wherein said second bracket comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations of said second bracket;

wherein one of said first outer support connection locations of said second bracket and said inner support connection location of said second bracket forms a connection of said second bracket and said base and the other of said first outer support connection location of said second bracket and said inner support connection location of said second bracket is rigidly connected with said second component;

wherein flexural strength of said first bracket in a region along said axis of rotation between said inner support connection location of said first bracket and a connecting line of said first and second outer support connection locations of said first bracket is considerably greater than the flexural strength in a region along a circumferential direction between said inner support connection location of said first bracket and said first and second outer support connection locations of said first bracket; and

wherein flexural strength of said second bracket in a region along said axis of

rotation between said inner support connection location of said second bracket and a connecting line of said first and second outer support connection locations of said second bracket is considerably greater than the flexural strength in a region along a circumferential direction between said inner support connection location of said second bracket and said first and second outer support connection locations of said second bracket.

13. (New) The coupling element of claim 12, wherein said inner support connection location of said first bracket forms a connection of said first bracket with said base, and said first and second outer support connection locations of said first bracket are rigidly connected with said first component.

14. (New) The coupling element of claim 13, wherein said inner support connection location of said second bracket forms a connection of said second bracket with said base, and said first and second outer support connection locations of said second bracket are rigidly connected with said second component.

15. (New) The coupling element of claim 12, wherein said inner support connection location of said first bracket is rigidly attached to said first component, and said first and second outer support connection locations of said first bracket form a connection of said first bracket and said base.

16. (New) The coupling element of claim 15, wherein said inner support

connection location of said second bracket is rigidly attached to said second component, and said first and second outer support connection locations of said second bracket form a connection of said second bracket and said base.

17. (New) The coupling element of claim 12, wherein said coupling element is formed of a piece of sheet metal shaped in one piece.

18. (New) The coupling element of claim 12, wherein said first and second outer support connection locations of said first and second brackets and said inner support connection locations of said first and second brackets are each located on a common plane that extends at a right angle to said axis of rotation.

19. (New) The coupling element of claim 12, wherein said first bracket is bent at a bending connection location so that said first bracket is bent at 90° with respect to said base, wherein said bending connection is one of said first outer support connection locations of said first bracket or said inner support connection location of said first bracket; and

said second bracket is bent at a second bending connection location so that said second bracket is bent at 90° with respect to said base, wherein said second bending connection is one of said first outer support connection locations of said second bracket or said inner support connection location of said second bracket.

20. (New) The coupling element of claim 18, wherein said first bracket is

bent at a bending connection location so that said first bracket is bent at 90° with respect to said base, wherein said bending connection is one of said first outer support connection locations of said first bracket or said inner support connection location of said first bracket; and

said second bracket is bent at a second bending connection location so that said second bracket is bent at 90° with respect to said base, wherein said second bending connection is one of said first outer support connection locations of said second bracket or said inner support connection location of said second bracket.

21. (New) The coupling element of claim 12, further comprising:

a third bracket rigidly fastened on said first component, wherein said third bracket is arranged opposite to said first bracket and extends parallel with said first bracket, and said first bracket and said third bracket constitute a first pair of brackets; and

a fourth bracket rigidly fastened on said second component, wherein said fourth bracket is arranged opposite to said second bracket and extends parallel with said second bracket, and said second bracket and said fourth bracket constitute a second pair of brackets.

22. (New) The coupling element of claim 12, wherein said base is axially resilient.

23. (New) The coupling element of claim 22, wherein said base comprises

a bend to make said base axial resilient.

24. (New) The coupling element of claim 23, wherein said bend comprises a bead.

25. (New) The coupling element of claim 13, wherein said first and second outer support connection locations of said first bracket are each a bore.

26. (New) The coupling element of claim 14, wherein said first and second outer support connection locations of said second bracket are each a bore.

27. (New) The coupling element of claim 15, wherein said inner support connection location of said first bracket is a bore.

28. (New) The coupling element of claim 16, wherein said inner support connection location of said second bracket is a bore.

29. (New) The coupling element of claim 21, wherein said first and third brackets are located parallel and opposite each other and are fastened on a first flange of a shaft adapter, and said second and fourth brackets extend perpendicular with respect to said first bracket and are located parallel and opposite each other, are fastened on a second flange of said shaft adapter.

30. (New) The coupling element of claim 29, wherein said first flange is rigidly fastened to a first shaft and said second flange is rigidly fastened to a second shaft.

31. (New) The coupling element of claim 30, wherein at least one of said first and second flanges has a bore for the radial clamping of one of said first and second shafts.

32. (New) The coupling element of claim 31, wherein one of said first and second shafts forms part of an angle-measuring device and said one of said first and second shafts is clamped in said bore.

33. (New) A coupling element for an angle-measuring device for connecting a first component to a second component in a radially resilient, but torsion-proof manner with respect to an axis of rotation, comprising:

a base;

a first pair of brackets arranged opposite and parallel to one another and are rigidly fastened on said base and said first component, wherein each of said first pair of brackets comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations, said first and second outer support connection locations of said first pair of brackets and said inner support connection

locations of said first pair of brackets are located on a common plane that extends at a right angle with respect to said axis of rotation;

wherein one of either each of said first outer support connection locations of said first pair of brackets and each of said inner support connection locations of said first pair of brackets forms a connection of said first pair of brackets and said base and the other of said each of said first outer support connection locations of said first pair of brackets and each of said inner support connection locations of said first pair of brackets are rigidly connected with said first component;

a second pair of brackets arranged opposite and parallel to one another and rigidly fastened on said base and on said second component and which extends at a right angle with respect to said first pair of brackets, wherein each of said second pair of brackets comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations of said second pair of brackets, said first and second outer support connection locations of said second pair of brackets and said inner support connection locations of said second pair of brackets are located on said common plane; and

wherein one of either each of said first outer support connection locations of said second pair of brackets and each of said inner support connection locations of said second pair of brackets forms a connection of said second pair of brackets and said base and the other of said each of said first outer support connection locations of said second pair of brackets and each of said inner support connection locations of

said second pair of brackets are rigidly connected with said second component.

34. (New) The coupling element of claim 33, wherein said coupling element is formed of a piece of sheet metal shaped in one piece.

35. (New) The coupling element of claim 33, wherein said first pair of brackets are bent at a first set of bending connection locations so that said first pair of brackets are bent at 90° with respect to said base.

36. (New) The coupling element of claim 35, wherein said second pair of brackets are bent at a second set of bending connection locations so that said second pair of brackets are bent at 90° with respect to said base.

37. (New) An angle measuring device comprising:

a scanning unit;

a stator;

a coupling element connected to said stator and said scanning unit in a torsion-proof, but radially resilient manner with respect to an axis of rotation, wherein said coupling element comprises:

a base;

a first bracket rigidly fastened on said base and said stator, wherein said first bracket comprises a first outer support connection location, a second outer support connection location and an inner support connection location

centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations;

wherein one of said first outer support connection locations of said first bracket and said inner support connection location of said first bracket forms a connection of said first bracket and said base and the other of said first outer support connection location of said first bracket and said inner support connection location of said first bracket is rigidly connected with said stator;

a second bracket rigidly fastened on said base and on said scanning unit and which extends at a right angle with respect to said first bracket, wherein said second bracket comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations of said second bracket;

wherein one of said first outer support connection locations of said second bracket and said inner support connection location of said second bracket forms a connection of said second bracket and said base and the other of said first outer support connection location of said second bracket and said inner support connection location of said second bracket is rigidly connected with said scanning unit;

wherein flexural strength of said first bracket in a region along said axis of rotation between said inner support connection location of said first bracket and a connecting line of said first and second outer support connection locations of said first bracket is considerably greater than the flexural strength in a region along a

circumferential direction between said inner support connection location of said first bracket and said first and second outer support connection locations of said first bracket; and

wherein flexural strength of said second bracket in a region along said axis of rotation between said inner support connection location of said second bracket and a connecting line of said first and second outer support connection locations of said second bracket is considerably greater than the flexural strength in a region along a circumferential direction between said inner support connection location of said second bracket and said first and second outer support connection locations of said second bracket.

38. (New) The angle measuring device of claim 37, wherein said inner support connection location of said first bracket forms a connection of said first bracket with said base, and said first and second outer support connection locations of said first bracket are rigidly connected with said stator.

39. (New) The angle measuring device of claim 37, wherein said inner support connection location of said second bracket forms a connection of said second bracket with said base, and said first and second outer support connection locations of said second bracket are rigidly connected with said scanning unit.

40. (New) The angle measuring device of claim 37, wherein said inner support connection location of said first bracket is rigidly attached to said stator, and

said first and second outer support connection locations of said first bracket form a connection of said first bracket and said base.

41. (New) The angle measuring device of claim 37, wherein said inner support connection location of said second bracket is rigidly attached to said scanning unit, and said first and second outer support connection locations of said second bracket form a connection of said second bracket and said base.

42. (New) The angle measuring device of claim 37, wherein said coupling element is formed of a piece of sheet metal shaped in one piece.

43. (New) The angle measuring device of claim 37, wherein said first and second outer support connection locations of said first and second brackets and said inner support connection locations of said first and second brackets are each located on a common plane that extends at a right angle to said axis of rotation.

44. (New) The angle measuring device of claim 37, wherein said first bracket is bent at a bending connection location so that said first bracket is bent at 90° with respect to said base, wherein said bending connection is one of said first outer support connection locations of said first bracket or said inner support connection location of said first bracket; and

said second bracket is bent at a second bending connection location so that said second bracket is bent at 90° with respect to said base, wherein said second

bending connection is one of said first outer support connection locations of said second bracket or said inner support connection location of said second bracket.

45. (New) The angle measuring device of claim 43, wherein said first bracket is bent at a bending connection location so that said first bracket is bent at 90° with respect to said base, wherein said bending connection is one of said first outer support connection locations of said first bracket or said inner support connection location of said first bracket; and

said second bracket is bent at a second bending connection location so that said second bracket is bent at 90° with respect to said base, wherein said second bending connection is one of said first outer support connection locations of said second bracket or said inner support connection location of said second bracket.

46. (New) The angle-measuring device of claim 37, further comprising:

a third bracket rigidly fastened on said stator, wherein said third bracket is arranged opposite to said first bracket and extends parallel with said first bracket and said first bracket and said third bracket constitute a first pair of brackets; and

a fourth bracket rigidly fastened on said scanning unit, wherein said fourth bracket is arranged opposite to said second bracket and extends parallel with said second bracket and said second bracket and said fourth bracket constitute a second pair of brackets.

47. (New) The angle measuring device of claim 37, wherein said base is axially resilient.

48. (New) The angle measuring device of claim 47, wherein said base comprises a bend to make said base axial resilient.

49. (New) The angle measuring device of claim 48, wherein said bend comprises a bead.

50. (New) The angle measuring device of claim 38, wherein said first and second outer support connection locations of said first bracket are each a bore.

51. (New) The angle measuring device of claim 39, wherein said first and second outer support connection locations of said second bracket are each a bore.

52. (New) The angle measuring device of claim 40, wherein said inner support connection location of said first bracket is a bore.

53. (New) The angle measuring device of claim 41, wherein said inner support connection location of said second bracket is a bore.

54. (New) An angle-measuring device comprising:

a scanning unit;

a stator;

a coupling element connected to said stator and said scanning unit in a torsion-proof, but radially resilient manner with respect to an axis of rotation, wherein said coupling element comprises:

a base;

a first pair of brackets arranged opposite and parallel to one another and are rigidly fastened on said base and said stator, wherein each of said first pair of brackets comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations, said first and second outer support connection locations of said first pair of brackets and said inner support connection locations of said first pair of brackets are located on a common plane that extends at a right angle with respect to said axis of rotation;

wherein one of either each of said first outer support connection locations of said first pair of brackets and each of said inner support connection locations of said first pair of brackets forms a connection of said first pair of brackets and said base and the other of said each of said first outer support connection locations of said first pair of brackets and each of said inner support connection locations of said first pair of brackets are rigidly connected with said stator;

a second pair of brackets arranged opposite and parallel to one another and rigidly fastened on said base and on said scanning unit and which extends at a right angle with respect to said first pair of brackets, wherein each of said second pair

of brackets comprises a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to said axis of rotation between said first and second outer support connection locations of said second pair of brackets, said first and second outer support connection locations of said second pair of brackets and said inner support connection locations of said second pair of brackets are located on said common plane; and

wherein one of either each of said first outer support connection locations of said second pair of brackets and each of said inner support connection locations of said second pair of brackets forms a connection of said second pair of brackets and said base and the other of said each of said first outer support connection locations of said second pair of brackets and each of said inner support connection locations of said second pair of brackets are rigidly connected with said scanning unit.

55. (New) The angle measuring device of claim 54, wherein said coupling element is formed of a piece of sheet metal shaped in one piece.

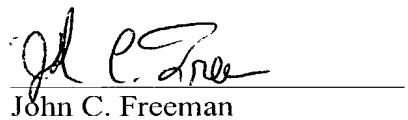
56. (New) The angle measuring device of claim 54, wherein said first pair of brackets are bent at a first set of bending connection locations so that said first pair of brackets are bent at 90° with respect to said base.

57. (New) The angle measuring device of claim 54, wherein said second pair of brackets are bent at a second set of bending connection locations so that said

second pair of brackets are bent at 90° with respect to said base.

Please note that new claims 12-57 are being presented to provide additional coverage regarding a measuring system. In addition, since the original claims reflect a literal translation of the claims of the corresponding Patent Cooperation Treaty, there is a need to stylize their language to everyday English and to use U.S. patent terminology. Accordingly, the cancellation of original claims 1-11 and the addition of new claims 12-65 are not being presented for reasons of patentability as defined in Festo Corporation v. Shoketsu Kinzoku Kogyo Kabushiki Co., Ltd., 234 F.3d 558, 56 USPQ2d 1865 (Fed. Cir. 2000).

Respectfully submitted,



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Marked up Version of Specification

COUPLING ELEMENT AND USE OF [SAID] THE COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

The present invention relates to a coupling element for connecting two components in a radially resilient, but torsion-proof manner.

For manufacturing such coupling elements in a cost- effective manner, they are made of one piece and shaped from sheet metal, such as described, for example, in DE 89 15 109 U1, EP 0 762 081 A1 and EP 0 762 082 A1. Note that EP 0 762 081 A1 corresponds to U.S. Patent No. 5,771,594 and EP 0 762 082 A1 corresponds to U.S. Patent No. 5,758,427, the entire contents of each of which are incorporated herein by reference. These coupling elements [consist of] include a flat center piece as the base, and of four brackets, formed thereon by bends. The brackets extend perpendicularly in relation to the level of the base, and respectively two brackets are arranged opposite and parallel to each other and [constitute] form a spring parallelogram for radial compensation. To achieve the function of a spring parallelogram, the brackets extend axially and are formed at one location of the base and can be rigidly connected with one of the two components at another location axially remote from the first. The torsion-proof property is reduced because of this axial remoteness and, in the course of a radial deflection of a spring parallelogram, the base is also unavoidably bent because of the axial linear change of the brackets. In an actual case, the base does not bend symmetrically here because of inhomogeneities in the base, because of which the base introduces an angular twist in the remaining two brackets, which causes a mutual twisting of the two components connected via the

coupling element.

SUMMARY AND OBJECTS OF THE INVENTION

It is [the] an object of the present invention to create a coupling element which is compactly and space-savingly constructed and can be produced cost-effectively. Moreover, radial compensation movements of the two components connected by [means of] the coupling element should be possible without introducing impermissible mutual twisting between the two components.

This object is attained by [means of a coupling element with the characteristics of claim 1] a coupling element for an angle-measuring device for connecting a first component to a second component in a radially resilient, but torsion-proof manner with respect to an axis of rotation. The coupling element including a base and a first bracket rigidly fastened on the base and the first component, wherein the first bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations. One of the first outer support connection locations of the first bracket and the inner support connection location of the first bracket forms a connection of the first bracket and the base and the other of the first outer support connection location of the first bracket and the inner support connection location of the first bracket is rigidly connected with the first component. A second bracket is rigidly fastened on the base and on the second component and which extends at a right angle with respect to the first bracket, wherein the second bracket has a first outer support connection location, a second outer support connection location and an

inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations of the second bracket. One of the first outer support connection locations of the second bracket and the inner support connection location of the second bracket forms a connection of the second bracket and the base and the other of the first outer support connection location of the second bracket and the inner support connection location of the second bracket is rigidly connected with the second component. Flexural strength of the first bracket in a region along the axis of rotation between the inner support connection location of the first bracket and a connecting line of the first and second outer support connection locations of the first bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the first bracket and the first and second outer support connection locations of the first bracket. Flexural strength of the second bracket in a region along the axis of rotation between the inner support connection location of the second bracket and a connecting line of the first and second outer support connection locations of the second bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the second bracket and the first and second outer support connection locations of the second bracket.

The present invention furthermore relates to the use of this coupling element in an angle-measuring device.

It is therefore a further object of the present invention to disclose an angle-measuring device, wherein the scanning unit is coupled to the stator of the angle-

measuring device in a particularly torsion-proof, but radially resilient manner and, if possible, no measuring errors result from radial compensation movements between the scanning unit and the stator.

This object is attained by [means of the angle-measuring device with the characteristics of claim 11] an angle-measuring device that includes a scanning unit, a stator and a coupling element connected to the stator and the scanning unit in a torsion-proof, but radially resilient manner with respect to an axis of rotation. The coupling element including a base and a first bracket rigidly fastened on the base and the first component, wherein the first bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations. One of the first outer support connection locations of the first bracket and the inner support connection location of the first bracket forms a connection of the first bracket and the base and the other of the first outer support connection location of the first bracket and the inner support connection location of the first bracket is rigidly connected with the first component. A second bracket is rigidly fastened on the base and on the second component and which extends at a right angle with respect to the first bracket, wherein the second bracket has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to the axis of rotation between the first and second outer support connection locations of the second bracket. One of the first outer support connection locations of the second bracket and the inner support

connection location of the second bracket forms a connection of the second bracket and the base and the other of the first outer support connection location of the second bracket and the inner support connection location of the second bracket is rigidly connected with the second component. Flexural strength of the first bracket in a region along the axis of rotation between the inner support connection location of the first bracket and a connecting line of the first and second outer support connection locations of the first bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the first bracket and the first and second outer support connection locations of the first bracket. Flexural strength of the second bracket in a region along the axis of rotation between the inner support connection location of the second bracket and a connecting line of the first and second outer support connection locations of the second bracket is considerably greater than the flexural strength in a region along a circumferential direction between the inner support connection location of the second bracket and the first and second outer support connection locations of the second bracket.

Particular advantages of the present invention are recited in the following description of exemplary embodiments. [Advantageous embodiments of the invention ensue from the dependent claims.]

Exemplary embodiments of the present invention are represented in the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1[,] shows a first exemplary embodiment of a coupling element, viewed

in the axial direction according to the present invention;[,]

FIG. 2[,] shows a lateral view [II – II] of the coupling element in accordance with FIG. 1 taken along line II-II of FIG. 1;[,]

FIG. 3[,] shows a stereoscopic representation of the coupling element in accordance with FIGS. 1 and 2;[,]

FIG. 4[,] shows a top view of an embodiment of a shaft adapter with the coupling element of FIGS. 1-3 in accordance with the [first exemplary embodiment,] present invention;

FIG. 5[,] shows a partial sectional view [section V – V] of the shaft adapter of FIG. 4 taken along lines V-V of FIG. 4 in accordance with FIG. 4[,];

FIG. 6[,] shows an embodiment of an angle-measuring device with the coupling element in accordance with the [first exemplary embodiment,] present invention;

FIG. 7[,] shows a second exemplary embodiment of a coupling element[,] in accordance with the present invention; and

FIG. 8[,] shows a stereoscopic representational view of a third exemplary embodiment of a coupling element in [a stereoscopic representation] accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT(S) OF THE INVENTION

A first exemplary embodiment of a coupling element 1 is represented in FIGS. 1 to 3. The coupling element 1 has been produced in one piece as a punched and bent element and is made of a material with a high degree of alternating stress resistance, in particular of spring steel. It [consists of] includes a flat center area as the base 2, as

well as four brackets 3, 4, 5, 6 formed thereon and bent at right angles. The brackets 3, 4, 5, 6 are aligned, at least to a large degree, parallel in relation to the axis D, they are furthermore arranged diametrically opposite each other and parallel with each other. The bracket 3 is arranged diametrically opposite and parallel with the bracket 5. The bracket 4 is also arranged diametrically opposite and parallel with the bracket 6, wherein the brackets 3 and 5 extend at right angles to the brackets 4 and 6.

Each bracket 3, 4, 5, 6 is fixed, centered atop a support on the base 2, and each bracket 3, 4, 5, 6 has respective further outer support connection locations or points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 on both sides of these inner support connection locations or points 3.1, 4.1, 5.1, 6.1. The diametrically oppositely located support points 3.2, 3.3 and 5.2, 5.3 are used for the rigid fastening of the brackets 3, 5 on one of the two components, and the diametrically oppositely located support points 4.2, 4.3 and 6.2, 6.3 are used for the rigid fastening of the brackets 4, 6 on the other of the two components. All support points 3.1 to 6.3 advantageously lie in a common plane that extends at a right angle to an axis of rotation D of a shaft 31 of a rotor 30. The inner support points 3.1, 4.1, 5.1, 6.1 are centered in a circumferential direction with respect to the axis C between corresponding outer support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.2, 6.2, 6.3. The support points 3.1, 4.1, 5.1, 6.1 are formed by bending lines between the base 2 and the brackets 3, 4, 5, 6. The support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 are embodied as bores for fastening by [means of] screws, wherein the centers of the bores are located together in the center plane of the base 2. However, other rigid fastening methods, for example welding, can also be provided. The three support points 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3 of each

bracket 3, 4, 5, 6 are advantageously located on a common straight line, wherein the extensions of the straight lines enclose a rectangular square.

The base 2 advantageously [consists of] includes four braces, which connect the support points 3.1, 4.1 and 4.1, 5.1 and 5.1, 6.1, as well as 6.1, 3.1 in one plane and enclose a square. In this case the center lines of the braces extend at least approximately in the direction of the lines of application of the force which is introduced at the support points 3.1, 4.1, 5.1, 6.1.

This described coupling element 1 can be employed in connection with angle-measuring devices in that it is inserted between the shaft of a drive mechanism and the shaft of an angle- measuring device. A shaft adapter 9 with the coupling element 1 in accordance with FIGS. 1 to 3 is represented in FIGS. 4 and 5. The coupling element 1 can be inserted in a particularly simple way between the shaft of the drive mechanism to be measured and the shaft of the angle-measuring device by [means of] this shaft adapter 9. The shaft adapter [consists of] includes a first flange 9.1, on which the shaft of the drive mechanism can be rigidly fastened, and of a second flange 9.2, on which the shaft of the angle-measuring device can be rigidly fastened. In the example represented, the first flange 9.1 is a plate with bores 9.11, so that the plate can be fixed in place on the shaft of the drive mechanism by being screwed together with it. The second flange 9.2 [consists of] includes a second plate with a centered bore 9.21, in which the shaft of the angle-measuring device can be fixed in place by radial clamping.

The two outer support points 6.2, 6.3 and 4.2, 4.3 of the two diametrically oppositely located brackets 6 and 4 are rigidly connected with the first flange 9.1 by

[means of] screws 8, and the two outer support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 extending at right angles to them are rigidly connected with the second flange 9.2 by [means of] screws 7. The two flanges 9.1, 9.2 are connected with each other via the coupling element 1 in a radially and axially resilient, but torsion-proof manner, in relation to the axis of rotation D. For reasons of clarity the support points of the brackets 3 to 5 have not been provided with reference symbols, reference is made with respect to this to FIG. 3. The shafts of the drive mechanism and of the angle-measuring device have also not been represented for reasons of clarity.

In a known manner, the angle-measuring device [consists of] includes a stationary part, also called mounting flange, of the angle- measuring device, or stator 10 in general, a scanning unit 20 and a rotating element, also called a rotor 30. The rotary position of the rotor 30 with respect to the stator 10 is measured. The rotor 30 in turn [consists of] includes a shaft 31, which is seated in the scanning unit 20 and on which a code disk 32 is fastened. The scanning unit 20 [consists of] includes a support body 21, on which a light source 22, a scanning plate 23 and a receiver unit 24 for the photoelectric scanning of the code disk 32 are arranged. The stator 10 can also be the stationary portion of a drive mechanism. For example the mounting flange of a motor, on which the scanning unit is installed.

The shaft 31 of this angle-measuring device can be rigidly installed on a shaft to be measured, because alignment errors are compensated by the coupling element 1, which is integrated into the angle-measuring device. For this purpose, the brackets 4 and 6 are rigidly fixed in place on the stator 10 of the angle measuring device via the

support points 4.2, 4.3, 6.2, 6.3. Only one of the screws 7 used for this is represented. The brackets 3 and 5 of the coupling element 1 are rigidly fixed in place on the scanning unit 20 by [means of] screws 8 via the support points 3.2, 3.3 and 5.2,. 5.3. Because of alignment errors between the shaft to be measured, not represented, and the shaft 32, the scanning unit 20 performs tumbling movements in relation to the stator 10, which are compensated by the coupling element 1 without the scanning unit 20 performing a rotation around the axis of rotation D in the process. If in the course of the rotation of the shaft 31 the scanning unit 20 is displaced in the radial direction R because of alignment errors, the support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 are displaced in this direction R with respect to the support points 3.1 and 5.1. Because of the symmetrical arrangement of the support points 3.2, 3.3 with respect to the center support point 3.1, as well as the support points 5.2, 5.3 with respect to the center support point 5.1, this displacement does not introduce a rotating movement into the coupling element 1. The actually occurring displacements are so small that they are compensated by the symmetrical stretching of the brackets 3 and 5 in the circumferential direction with respect to the axis of rotation D between inner support points 3.1, 4.1, 5.1, 6.1 and the outer support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3. In connection with displacements of the scanning unit 20 in the radial direction perpendicular to R, the support point 6.1 is radially moved with respect to the support points 6.2 and 6.3, and the support point 4.1 is also radially moved with respect to the support points 4.2 and 4.3. The changes in distance occurring here between the support points 6.2, 6.1, 6.3 of the bracket 6, and between the support points 4.2, 4.1, 4.3 of the bracket 4, are again compensated by the symmetrical stretching in the

brackets 6, 4.

A second exemplary embodiment of a coupling element 1 is represented in FIG. 7. Since it essentially corresponds to the first exemplary embodiment, the same reference symbols are used and the description is limited to the differences. If particularly strong axial stiffness is demanded, the base 2 can be mechanically reinforced by [means of] the application of beads 2.1. If an axial fastening of the sheet metal brackets 3, 4, 5, 6, which are bent at right angles in relation to the base, is demanded, the ends with the support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 can be bent over into the plane of the base 2. All support points 3.1 to 6.3 (centers of the fastening points) again lie in a common plane.

The further exemplary embodiment in accordance with FIG. 8 shows a coupling unit 100, wherein the brackets 103 to 106 are formed on the base 102 by [means of] their ends being bent at right angles, wherein the support points 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3, which are formed by the bending lines, are located in a common plane, in which the further support points 103.1, 104.1, 105.1, 106.1, which are symmetrically arranged between these support points 103.2 to 106.3, also lie. The center support points 103.1, 105.1 of the brackets 103, 105, which are located parallel across from each other, are used for fastening on one component (for example the first flange 9.1 in accordance with FIG. 4, or the stator 10 in accordance with FIG. 6), and the center support points 104.1, 106.1 of the further brackets 104, 106, which are located parallel across from each other, are used for fastening on the further two components (for example the second flange 9.2 in accordance with FIG. 4, or the scanning unit 20 in accordance with FIG. 6).

The described coupling elements 1 and 100 have optimal dimensions, if all support points (3.1 to 6.3, 103.1 to 106.3) are located on a common straight line, and if furthermore all support points (3.1 to 6.3, 103.1 to 106.3) of all brackets (3, 4, 5, 6, 103, 104, 105, 106) are located in a common plane. For reasons of the available fastening opportunities it may be necessary to arrange the center support points slightly axially offset (parallel with the axis D) with respect to the further support points. The effect in accordance with the present invention of the coupling element is preserved, if the flexural strength of the brackets 3, 4, 5, 6 between the respective center support points 3.1, 4.1, 5.1, 6.1 and the connecting line with the further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the axial direction, also parallel with axis D), is considerably greater than the flexural strength between the center support points 3.1, 4.1, 5.1, 6.1 and the two further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the circumferential direction, i.e. transversely to the axis D), so that in case of a radial displacement of the further support points with respect to the center support point, the brackets are respectively bent between the two further (outer) support points and are therefore stretched.

I Claim:

Coupling Element and Use of Said Coupling Element in a Device for Measuring Angles

The invention relates to a coupling element for connecting two components in a radially resilient, but torsion-proof manner.

For manufacturing such coupling elements in a cost- effective manner, they are made of one piece and shaped from sheet metal, such as described, for example, in DE 89 15 109 U1, EP 0 762 081 A1 and EP 0 762 082 A1. These coupling elements consist of a flat center piece as the base, and of four brackets, formed thereon by bends. The brackets extend perpendicularly in relation to the level of the base, and respectively two brackets are arranged opposite and parallel to each other and constitute a spring parallelogram for radial compensation. To achieve the function of a spring parallelogram, the brackets extend axially and are formed at one location of the base and can be rigidly connected with one of the two components at another location axially remote from the first. The torsion-proof property is reduced because of this axial remoteness and, in the course of a radial deflection of a spring parallelogram, the base is also unavoidably bent because of the axial linear change of the brackets. In an actual case, the base does not bend symmetrically here because of inhomogeneities in the base, because of which the base introduces an angular twist in the remaining two brackets, which causes a mutual twisting of the two components connected via the coupling element.

It is the object of the invention to create a coupling element which is compactly and space-savingly constructed and can be produced cost-effectively. Moreover, radial compensation movements of the two components connected by means of the coupling element should be possible without introducing impermissible mutual twisting between the two components.

This object is attained by means of a coupling element with the characteristics of claim 1.

The invention furthermore relates to the use of this coupling element in an angle-measuring device.

As mentioned in DE 89 15 109 U1, EP 0 762 081 A1 and EP 0 762 082 A1, coupling elements are employed in angle-measuring devices for the torsion-proof, but radially and axially resilient connection of the scanning unit to a stator of the angle-measuring device. Here, a mutual twisting of the scanning unit in relation to the stator results in a measuring error by the

angle-measuring device.

It is therefore a further object of the invention to disclose an angle-measuring device, wherein the scanning unit is coupled to the stator of the angle-measuring device in a particularly torsion-proof, but radially resilient manner and, if possible, no measuring errors result from radial compensation movements between the scanning unit and the stator.

This object is attained by means of the angle-measuring device with the characteristics of claim 11.

Particular advantages of the invention are recited in the following description of exemplary embodiments. Advantageous embodiments of the invention ensue from the dependent claims.

Exemplary embodiments of the invention are represented in the drawings.

Shown are in:

FIG. 1, a first exemplary embodiment of a coupling element, viewed in the axial direction,

FIG. 2, a lateral view II - II of the coupling element in accordance with FIG. 1,

FIG. 3, a stereoscopic representation of the coupling element in accordance with FIGS. 1 and 2,

FIG. 4, a shaft adapter with the coupling element in accordance with the first exemplary embodiment,

FIG. 5, a partial section V - V of the shaft adapter in accordance with FIG. 4,

FIG. 6, an angle-measuring device with the coupling element in accordance with the first exemplary embodiment,

FIG. 7, a second exemplary embodiment of a coupling element, and

FIG. 8, a third exemplary embodiment of a coupling element in a stereoscopic representation.

A first exemplary embodiment of a coupling element 1 is represented in FIGS. 1 to 3. The coupling element 1 has been produced in one piece as a punched and bent element and is made of a material with a high degree of alternating stress resistance, in particular of spring steel. It consists of a flat center area as the base 2, as well as four brackets 3, 4, 5, 6 formed thereon and bent at right angles. The brackets 3, 4, 5, 6 are aligned, at least to a large degree, parallel in relation to the axis D, they are furthermore arranged diametrically opposite each other and parallel with each other. The bracket 3 is arranged diametrically opposite and parallel with the bracket 5. The bracket 4 is also arranged diametrically opposite and parallel with the bracket 6, wherein the brackets 3 and 5 extend at right angles to the brackets 4 and 6.

Each bracket 3, 4, 5, 6 is fixed, centered atop a support on the base 2, and each bracket 3, 4, 5, 6 has respective further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 on both sides of these support points 3.1, 4.1, 5.1, 6.1. The diametrically oppositely located support points 3.2, 3.3 and 5.2, 5.3 are used for the rigid fastening of the brackets 3, 5 on one of the two components, and the diametrically oppositely located support points 4.2, 4.3 and 6.2, 6.3 are used for the rigid fastening of the brackets 4, 6 on the other of the two components. All support points 3.1 to 6.3 advantageously lie in a common plane. The support points 3.1, 4.1, 5.1, 6.1 are formed by bending lines between the base 2 and the brackets 3, 4, 5, 6. The support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 are embodied as bores for fastening by means of screws, wherein the centers of the bores are located together in the center plane of the base 2. However, other rigid fastening methods, for example welding, can also be provided. The three support points 3.1, 3.2, 3.3, 4.1, 4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.3 of each bracket 3, 4, 5, 6 are advantageously located on a common straight line, wherein the extensions of the straight

lines enclose a rectangular square.

The base 2 advantageously consists of four braces, which connect the support points 3.1, 4.1 and 4.1, 5.1 and 5.1, 6.1, as well as 6.1, 3.1 in one plane and enclose a square. In this case the center lines of the braces extend at least approximately in the direction of the lines of application of the force which is introduced at the support points 3.1, 4.1, 5.1, 6.1.

This described coupling element 1 can be employed in connection with angle-measuring devices in that it is inserted between the shaft of a drive mechanism and the shaft of an angle-measuring device. A shaft adapter 9 with the coupling element 1 in accordance with FIGS. 1 to 3 is represented in FIGS. 4 and 5. The coupling element 1 can be inserted in a particularly simple way between the shaft of the drive mechanism to be measured and the shaft of the angle-measuring device by means of this shaft adapter 9. The shaft adapter consists of a first flange 9.1, on which the shaft of the drive mechanism can be rigidly fastened, and of a second flange 9.2, on which the shaft of the angle- measuring device can be rigidly fastened. In the example represented, the first flange 9.1 is a plate with bores 9.11, so that the plate can be fixed in place on the shaft of the drive mechanism by being screwed together with it. The second flange 9.2 consists of a second plate with a centered bore 9.21, in which the shaft of the angle-measuring device can be fixed in place by radial clamping.

The two outer support points 6.2, 6.3 and 4.2, 4.3 of the two diametrically oppositely located brackets 6 and 4 are rigidly connected with the first flange 9.1 by means of screws 8, and the two outer support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 extending at right angles to them are rigidly connected with the second flange 9.2 by means of screws 7. The two flanges 9.1, 9.2 are connected with each other via the coupling element 1 in a radially and axially resilient, but torsion-proof manner, in relation to the axis of rotation D. For reasons of clarity the support points of the brackets 3 to 5 have not been provided with reference symbols, reference is made with respect to this to FIG. 3. The shafts of the drive mechanism and of the angle-measuring device have also not been represented for reasons of clarity.

The use of the coupling element 1 is particularly advantageous for the torsion-proof, but axially and radially resilient connection of a scanning unit 20 of an angle-measuring device to a stator 10 of this angle-measuring device. This application is represented in partial section in FIG. 6.

In a known manner, the angle-measuring device consists of a stationary part, also called mounting flange, of the angle- measuring device, or stator 10 in general, a scanning unit 20 and

a rotating element, also called a rotor 30. The rotary position of the rotor 30 with respect to the stator 10 is measured. The rotor 30 in turn consists of a shaft 31, which is seated in the scanning unit 20 and on which a code disk 32 is fastened. The scanning unit 20 consists of a support body 21, on which a light source 22, a scanning plate 23 and a receiver unit 24 for the photoelectric scanning of the code disk 32 are arranged. The stator 10 can also be the stationary portion of a drive mechanism. for example the mounting flange of a motor, on which the scanning unit is installed.

The shaft 31 of this angle-measuring device can be rigidly installed on a shaft to be measured, because alignment errors are compensated by the coupling element 1, which is integrated into the angle-measuring device. For this purpose, the brackets 4 and 6 are rigidly fixed in place on the stator 10 of the angle measuring device via the support points 4.2, 4.3, 6.2, 6.3. Only one of the screws 7 used for this is represented. The brackets 3 and 5 of the coupling element 1 are rigidly fixed in place on the scanning unit 20 by means of screws 8 via the support points 3.2, 3.3 and 5.2,. 5.3. Because of alignment errors between the shaft to be measured, not represented, and the shaft 32, the scanning unit 20 performs tumbling movements in relation to the stator 10, which are compensated by the coupling element 1 without the scanning unit 20 performing a rotation around the axis of rotation D in the process. If in the course of the rotation of the shaft 31 the scanning unit 20 is displaced in the radial direction R because of alignment errors, the support points 3.2, 3.3 and 5.2, 5.3 of the brackets 3 and 5 are displaced in this direction R with respect to the support points 3.1 and 5.1. Because of the symmetrical arrangement of the support points 3.2, 3.3 with respect to the center support point 3.1, as well as the support points 5.2, 5.3 with respect to the center support point 5.1, this displacement does not introduce a rotating movement into the coupling element 1. The actually occurring displacements are so small that they are compensated by the symmetrical stretching of the brackets 3 and 5 in the circumferential direction. In connection with displacements of the scanning unit 20 in the radial direction perpendicular to R, the support point 6.1 is radially moved with respect to the support points 6.2 and 6.3, and the support point 4.1 is also radially moved with respect to the support points 4.2 and 4.3. The changes in distance occurring here between the support points 6.2, 6.1, 6.3 of the bracket 6, and between the support points 4.2, 4.1, 4.3 of the bracket 4, are again compensated by the symmetrical stretching in the brackets 6, 4.

If the scanning unit 20 is also displaced in the axial direction because of tumbling

movements of the shaft 31, this movement is compensated by the base 2.

The angle-measuring device can be an incremental angle encoder - preferably of the photoelectric type -, an absolute value encoder or a resolver.

It has been shown that the transfer behavior of this coupling element 1 is improved in comparison with known couplings, along with cost-effective manufacture and space-saving installation options. The coupling element 1 has a high vibration resistance because of the low mass, very good angular transfer accuracy and good thermal behavior. It can be cost-effectively produced and installed as a punched and bent element and is insensitive to fluctuations in the thickness of the material and strength in the area of the four center connecting braces, because these always remain flat during a radial deflection of the coupling element. It is therefore also possible to easily optimize the radial and axial stiffness independently of each other by varying the sheet metal thickness, or by the application of stiffening bends, for example in the form of beads or by crimping of the base 2.

A second exemplary embodiment of a coupling element 1 is represented in FIG. 7. Since it essentially corresponds to the first exemplary embodiment, the same reference symbols are used and the description is limited to the differences. If particularly strong axial stiffness is demanded, the base 2 can be mechanically reinforced by means of the application of beads 2.1. If an axial fastening of the sheet metal brackets 3, 4, 5, 6, which are bent at right angles in relation to the base, is demanded, the ends with the support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 can be bent over into the plane of the base 2. All support points 3.1 to 6.3 (centers of the fastening points) again lie in a common plane.

The further exemplary embodiment in accordance with FIG. 8 shows a coupling unit 100, wherein the brackets 103 to 106 are formed on the base 102 by means of their ends being bent at right angles, wherein the support points 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3, which are formed by the bending lines, are located in a common plane, in which the further support points 103.1, 104.1, 105.1, 106.1, which are symmetrically arranged between these support points 103.2 to 106.3, also lie. The center support points 103.1, 105.1 of the brackets 103, 105, which are located parallel across from each other, are used for fastening on one component (for example the first flange 9.1 in accordance with FIG. 4, or the stator 10 in accordance with FIG. 6), and the center support points 104.1, 106.1 of the further brackets 104, 106, which are located parallel across from each other, are used for fastening on the further two components (for example the second flange 9.2 in accordance with FIG. 4, or

the scanning unit 20 in accordance with FIG. 6).

In a manner not represented it is also possible to arbitrarily combine the details of the coupling elements 1, 100, represented in FIGS. 3, 7 and 8, for example, a coupling element can have two brackets 3, 5 in accordance with FIG. 3, and two oppositely located brackets 104, 106 in accordance with FIG. 8, which are arranged perpendicularly to the first.

The described coupling elements 1 and 100 have optimal dimensions, if all support points (3.1 to 6.3, 103.1 to 106.3) are located on a common straight line, and if furthermore all support points (3.1 to 6.3, 103.1 to 106.3) of all brackets (3, 4, 5, 6, 103, 104, 105, 106) are located in a common plane. For reasons of the available fastening opportunities it may be necessary to arrange the center support points slightly axially offset (parallel with the axis D) with respect to the further support points. The effect in accordance with the invention of the coupling element is preserved, if the flexural strength of the brackets 3, 4, 5, 6 between the respective center support points 3.1, 4.1, 5.1, 6.1 and the connecting line with the further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the axial direction, also parallel with axis D), is considerably greater than the flexural strength between the center support points 3.1, 4.1, 5.1, 6.1 and the two further support points 3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3 (course of the brackets in the circumferential direction, i.e. transversely to the axis D), so that in case of a radial displacement of the further support points with respect to the center support point, the brackets are respectively bent between the two further (outer) support points and are therefore stretched.

Claims

1. A coupling element (1, 100) for connecting two components (9.1, 9.2, 10, 20) in a radially resilient, but torsion-proof manner, consisting of a piece of sheet metal shaped in one piece, having

- a base (2, 102),

- several brackets (3, 4, 5, 6, 103, 104, 105, 106) formed on the base (2, 102), wherein

- at least one of the brackets (4, 6, 104, 106) can be rigidly fastened on one of the two components (9.1, 10), and at least one further bracket (3, 5, 103, 105) can be rigidly fastened on the other one of the two components (9.2, 20), and

- each bracket (3 to 6, 103 to 106) has three support points (3.1 to 6.3, 103.1 to 106.3), which are spaced apart from each other in the circumferential direction, and

- respectively one of the support points (3.1, 4.1, 5.1, 6.1, 103.1, 104.1, 105.1, 106.1) is located, centered in the circumferential direction between the other two support points (3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3), and

- the center support point (3.1, 4.1, 5.1, 6.1) forms the connection of the bracket (3, 4, 5, 6) with the base (2), and the two further support points (3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3) can be rigidly connected with one of the two components (9.1, 9.2, 10, 20), or the center support point (103.1, 104.1, 105.1, 106.1) can be rigidly connected with one of the two components (9.1, 9.2, 10, 20), and the two further support points (103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3) form the connection of the bracket (103, 104, 105, 106) with the base (102), characterized in that

- the flexural strength of the brackets (3, 4, 5, 6, 103, 104, 105, 106) between the center support points (3.1, 4.1, 5.1, 6.1, 103.1, 104.1, 105.1, 106.1) and the connecting line of the further support points (3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3) is considerably greater than the flexural strength between the center support points (3.1, 4.1, 5.1, 6.1, 103.1, 104.1, 105.1, 106.1) and the two further support points (3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 103.2, 103.3, 104.2, 104.3, 105.2, 105.3, 106.2, 106.3).

 Replacement Claim

2. The coupling element in accordance with claim 1, characterized in that all support points (3.1 to 6.3, 103.1 to 106.3) are located on a common plane.

3. The coupling element in accordance with claim 1 or 2, characterized in that

- four brackets (3 to 6, 103 to 106) are formed on the base (2, 102) by being bent at 90□ with respect to the base (2, 102),

- the bending point constitutes at least one of the support points (3.1, 4.1, 5.1, 6.1, 103.1, 104.1, 105.1, 106.1),

- respectively two brackets (3, 5, 4, 6, 103, 105, 104, 106) are arranged opposite each other and extending parallel with each other and constitute a pair of brackets,

- the two pairs of brackets extend at right angles with respect to each other,

- the support points (3.1 to 6.3, 103.1 to 106.3) of all brackets (3 to 6, 103 to 106) are located om the plane of the base (2, 102).

4. The coupling element in accordance with one of the preceding claims, characterized in that the base (2, 102) is embodied to be axially resilient.

5. The coupling element in accordance with one of the preceding claims, characterized in that the axial resilience of the base (2, 102) is increased by means of bends, in particular beads.

6. The coupling element in accordance with one of the preceding claims, characterized in that the support points for the rigid fastening of the brackets (3 to 6, 103 to 106) to the two components (9.1, 9.2, 10, 20) are bores (3.2, 3.3, 4.2, 4.3, 5.2, 5.3, 6.2, 6.3, 103.1, 104.1, 105.1, 106.1).

7. The coupling element in accordance with one of the preceding claims, characterized in that two first brackets (4, 6), which are located parallel and opposite each other, are fastened on a first flange (9.1) of a shaft adapter (9), and two brackets (3, 5) which extend perpendicular with respect to the first brackets (4, 6) and are located parallel and opposite each other, are fastened on a second flange (9.2) of the shaft adapter (9).

8. The coupling element in accordance with claim 7, characterized in that each of the flanges (9.1, 9.2) has means (9.11, 9.21) for rigid fastening of a shaft.

9. The coupling element in accordance with claim 8, characterized in that at least one of the flanges (9.2) has a bore (9.21), in particular for the radial clamping of a shaft.

10. The coupling element in accordance with claim 9, characterized in that a shaft of an angle-measuring device is clamped in the bore (9.21) of the flange (9.2).

11. An angle-measuring device, having a shaft (31), which is rotatably fastened on a scanning unit (20), and a coupling element (1) in accordance with one of the preceding claims 1 to 6, wherein the scanning unit (20) is connected to a stator (10) by means of this coupling element (1) in a torsion-proof, but radially resilient manner.

Abstract of the Disclosure

A coupling element including a base, and a first bracket and a second bracket each rigidly fastened on the base and rigidly fastened to the first component and second component, respectively. Each of the brackets has a first outer support connection location, a second outer support connection location and an inner support connection location centered in a circumferential direction with respect to an axis of rotation between the first and second outer support connection locations. For each of the brackets, one of the first outer support connection locations and the inner support connection location forms a connection of the corresponding bracket and the base and the other of the first outer support connection location and the inner support connection location is rigidly connected with either the first or second component.

FIG. 1

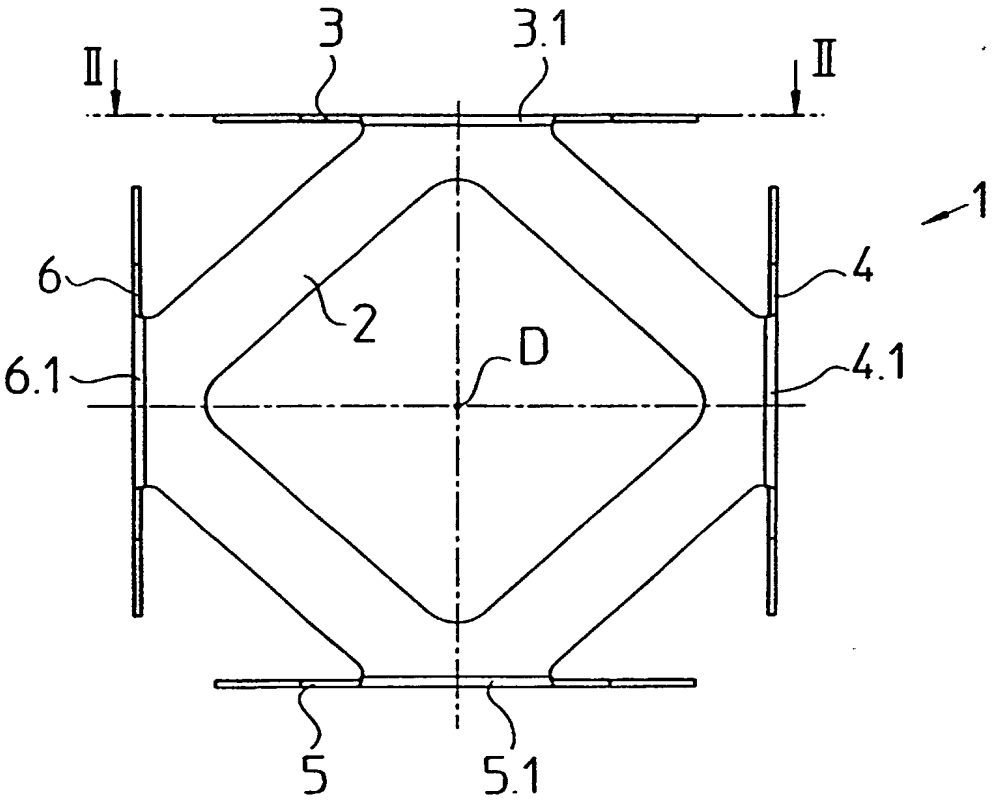


FIG. 2

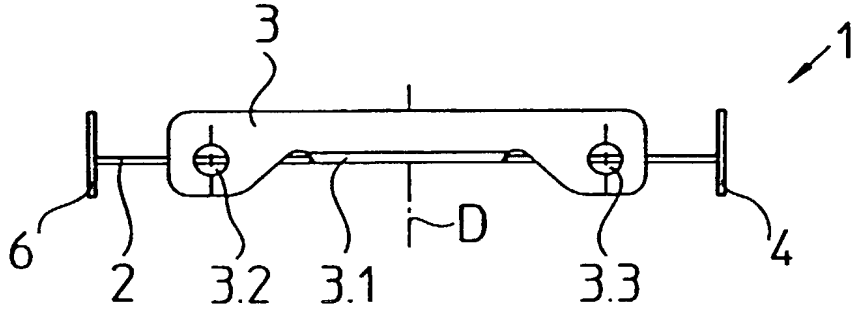


FIG. 3

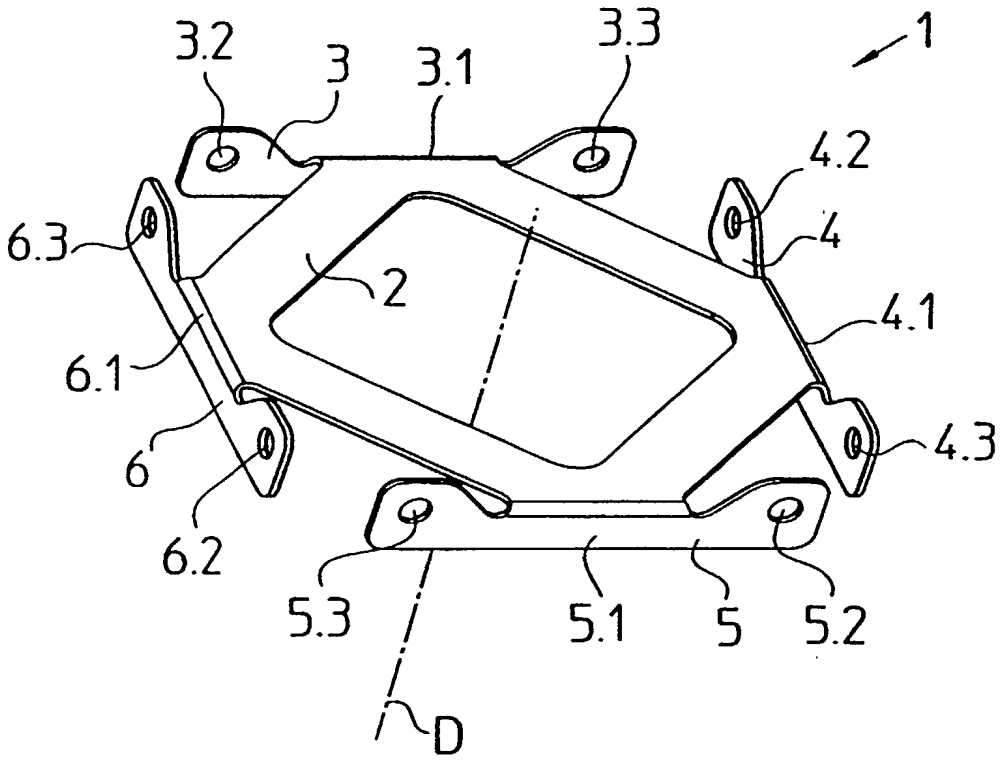


FIG. 4

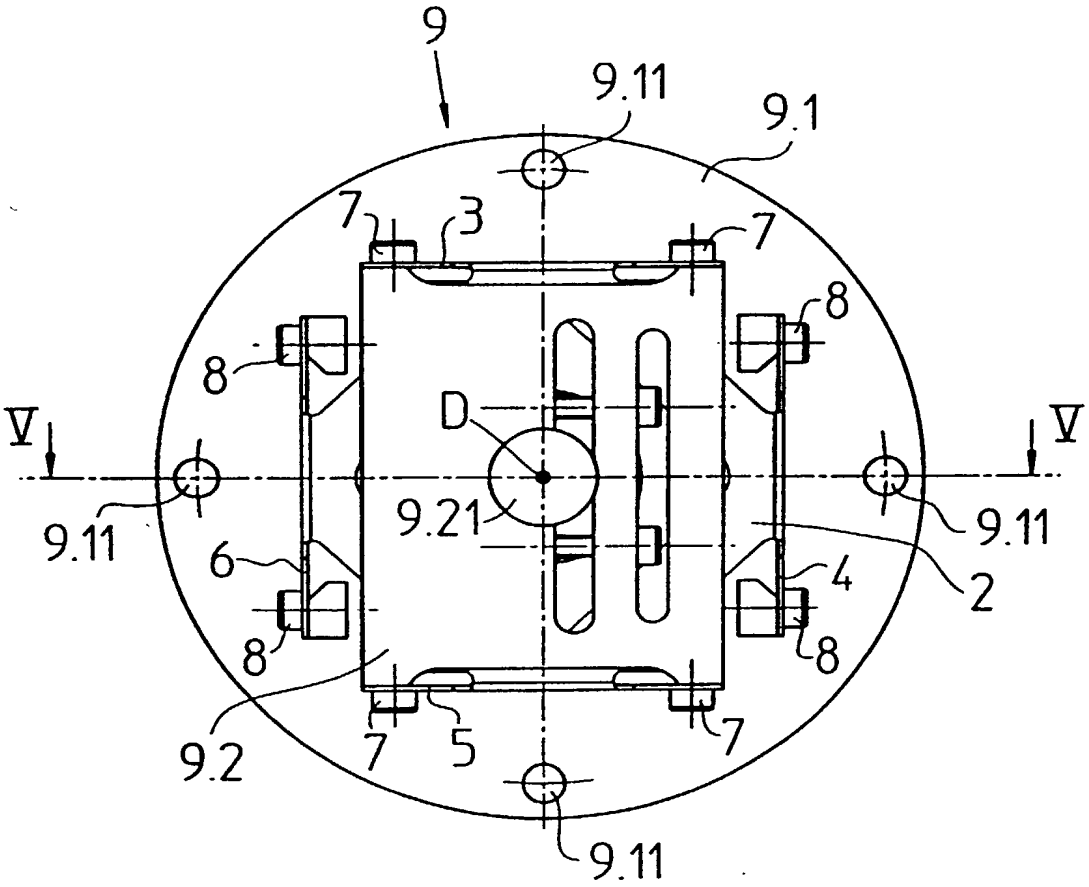

9
9.11
9.1
7
3
7
8
8
D
V
V
9.11
9.21
9.11
6
4
2
8
8
9.2
7
5
7
9.11

FIG. 5

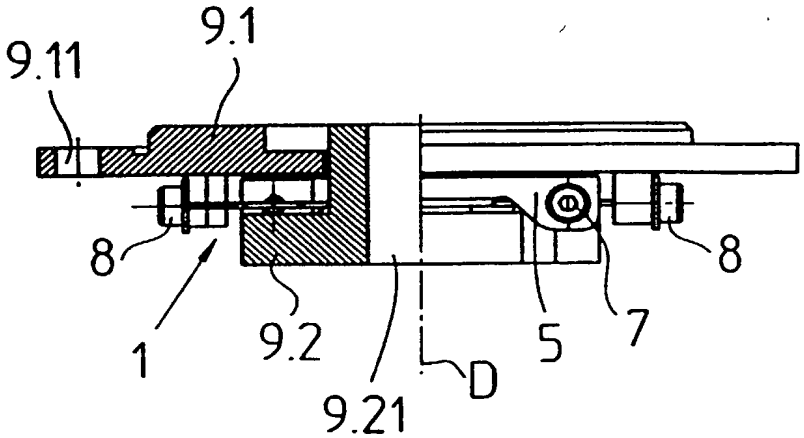

9.11
9.1
8
8
1
9.2
9.21
D
5
7

FIG. 6

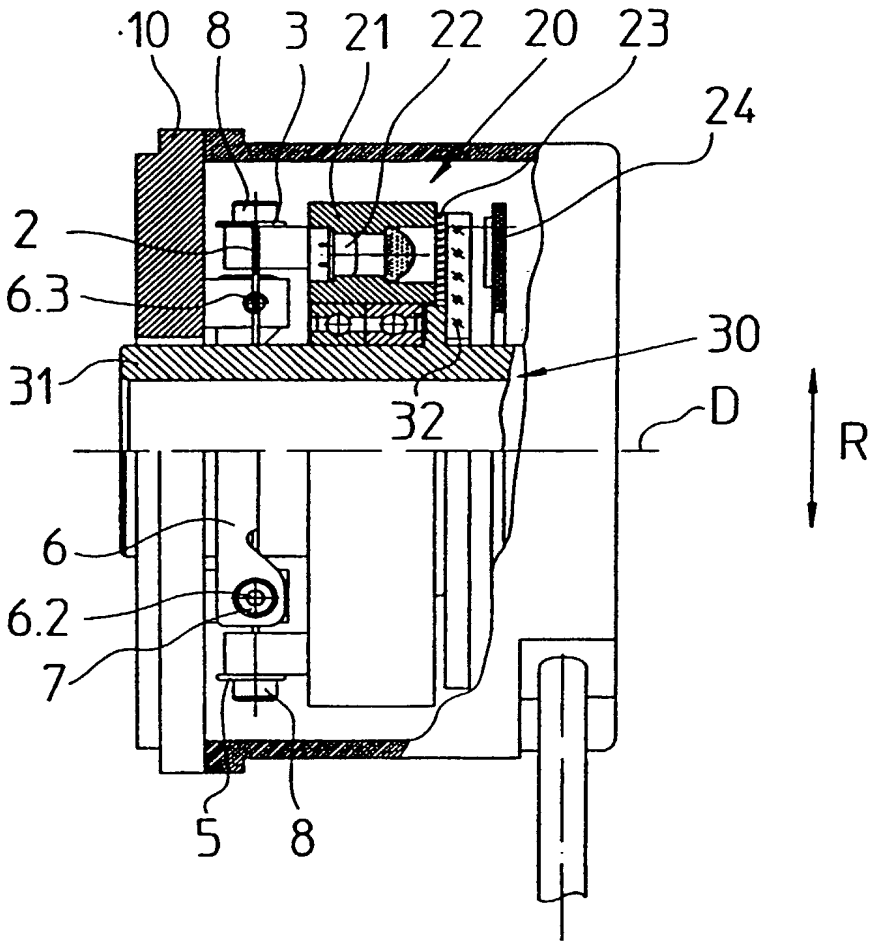


FIG. 7

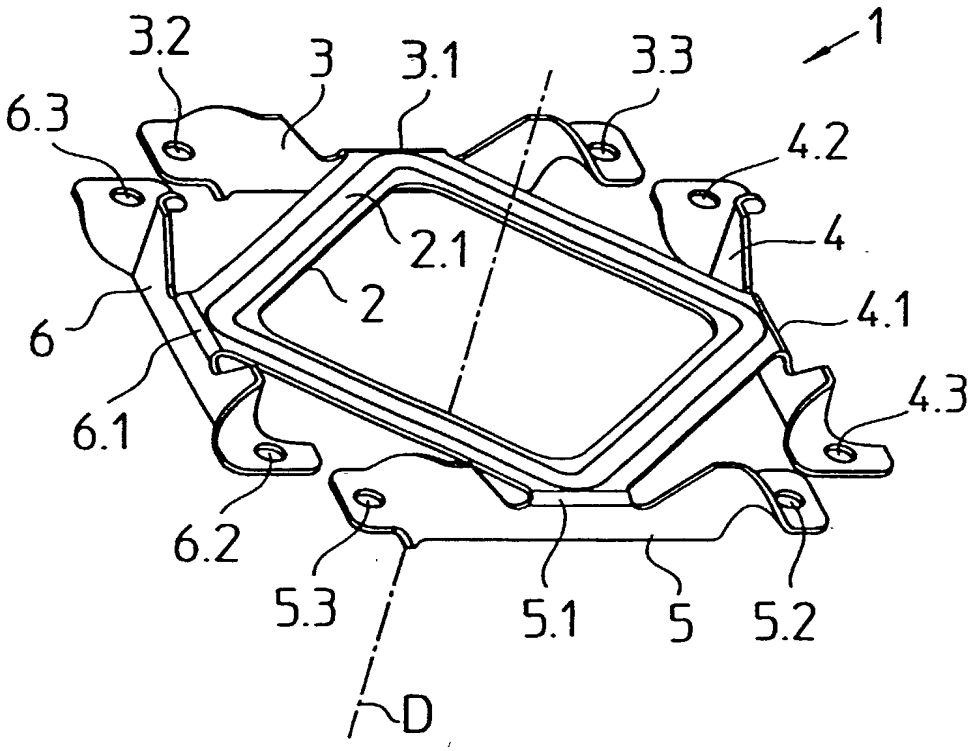
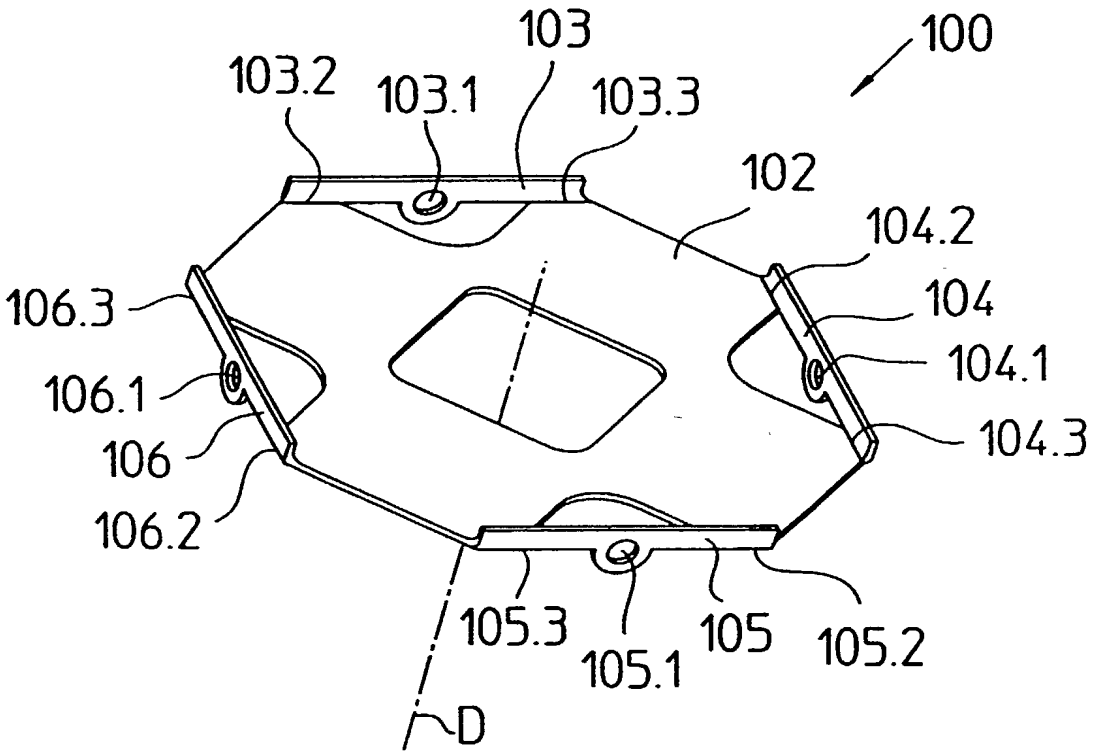


FIG. 8


103
100
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103.1
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D

Declaration and Power of Attorney For Patent Application
Erklärung Für Patentanmeldungen Mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

dass mein Wohnsitz. meine Postanschrift. und meine Staatsangehöngkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen.

dass ich. nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher. erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestelt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

COUPLING ELEMENT AND USE OF THE COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

deren Beschreibung

(zutreffendes ankreuzen)

__ hier beigefügt ist.

X_ am December 28, 2001 unter der

Anmeldungsseriennummer 10/019,734

eingereicht wurde und am Decembert 28, 2001 abgeändert wurde (falls tatsächlich abgeändert).

Ich bestätige hiermit. dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe. die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

Ich erkenne meine Pflicht zur Offenbarung irgendweicher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind. an.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

COUPLING ELEMENT AND USE OF THE COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

the specification of which

(check one)

__ is attached hereto.

X_ was filed on December 28, 2001 as

Application Serial No. 10/019,734

and was amended on December 28, 2001 (if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

German Language Declaration

Prior foreign applications
Priorität beansprucht

			Priority Claimed	
299 11 508.9	Germany	01/07/99	x	
(Number)	(Country)	(Day Month/Year Filed)	Yes	No
(Nummer)	(Land)	(Tag; Monat; Jahr eingereicht)	Ja	Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 112 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s) listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

PCT/EP00/05372	10/06/00	Completed	Completed
(Application Serial No.)	(Filing Date)	(Status)	(Status)
(Anmeldesenennummer)	(Anmeldedatum)	(patenbert, anhängig, aufgegeben)	(patented, pending, abandoned)

Ich erkläre hiermit, dass alle von mir in der vorliegenden Erklärung gemachten Angaben nach meinem besten Wissen und Gewissen der vollen Wahrheit entsprechen, und dass ich diese eidesstattliche Erklärung in Kenntnis dessen abgebe, dass wissentlich und vorsätzlich falsche Angaben gemäss Paragraph 1001. Absatz 18 der Zivilprozessordnung der Vereinigten Staaten von Amerika mit Geldstrafe belegt und/oder Gefängnis bestraft werden koennen, und dass derartig wissentlich und vorsätzlich falsche Angaben die Gültigkeit der vorliegenden Patentanmeldung oder eines darauf erteilten Patentes gefährden können.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLLMACHT: Als benannter Erfinder beauftrage ich hiermit den nachstehend benannten Patentanwalt (oder die nachstehend benannten Patentanwälte) und/oder Patent-Agenten mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Geschafte vor dem Patent-und Warenzeichenamt:
(Name und Registrations nummer anführen)

See Attached Exhibit "A"

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

See Attached Exhibit "A"

John C. Freeman (312) 321-4262

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Chicago, IL 60610

Voller Name des einzigen oder ursprunglichen Erfinders: Johann Mitterreiter	Full name of sole or first inventor: Johann Mitterreiter
Unterschrift des Erfinders Datum	Inventor's signature Date 5/23/2002
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Staatsangehorigkeit Germany	Citizenship Germany
Postanschrift Fehling 10 D-83339 Chieming Germany	Post Office Address Fehling 10 D-83339 Chieming Germany

over

Case No. 56/367

Inventor(s): Johann Mitterreiter

Title: COUPLING ELEMENT AND USE OF THE COUPLING ELEMENT IN A DEVICE FOR MEASURING ANGLES

"Exhibit A"

POWER OF ATTORNEY

The specification of the above-identified patent application:

☐ is attached hereto
☒ was filed on December 28, 2001 as application Serial No. 10/019,734

I hereby revoke all previously granted powers of attorney in the above-identified patent application and appoint the following attorneys to prosecute said patent application and to transact all business in the Patent and Trademark Office connected therewith:

John C Freeman (34,483)
Kent E Genin (37,834)

Please address all correspondence and telephone calls to John C. Freeman in care of:

Customer No. 59757

Brinks Hofer Gilson & Lione
NBC Tower, Suite 3600
P.O. Box 10395
Chicago, IL 60610
(312)321-4200

The undersigned hereby authorizes the U.S. attorneys named herein to accept and follow instructions from _____ as to any action to be taken in the Patent and Trademark Office regarding this application without direct communication between the U.S. attorney and the undersigned. In the event of a change in the persons from whom instructions may be taken, the U.S. attorneys named herein will be so notified by the undersigned.

Johann Mitterreiter Date: 5/23/2007

Inventor: Johann Mitterreiter